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(54) Torsional vibration damper for clutch plates

(57) A torsional vibration damper, particularly for use in a friction clutch driven plate incorporates the usual coil springs 23 arranged in windows 19, 21, 22, respectively in side plates 15 and 16 of a driving member and flange 13 of a driven member. Each spring 23 is provided with a coating 28 of low friction wear resistant material such as nylon. It has been found that by positively introducing low friction between the springs and windows the friction damping achieved within the driven plate, particularly at high rotational speeds, is more predictable for any individual driven plate.

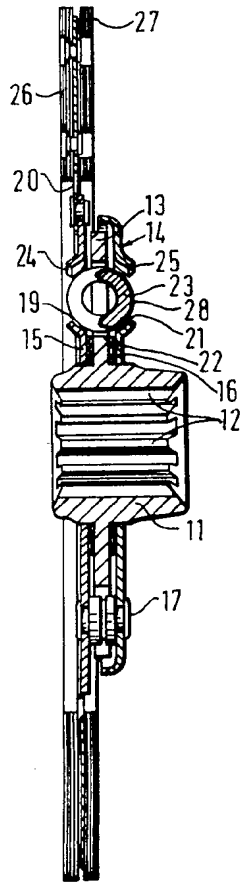

FIG. 2

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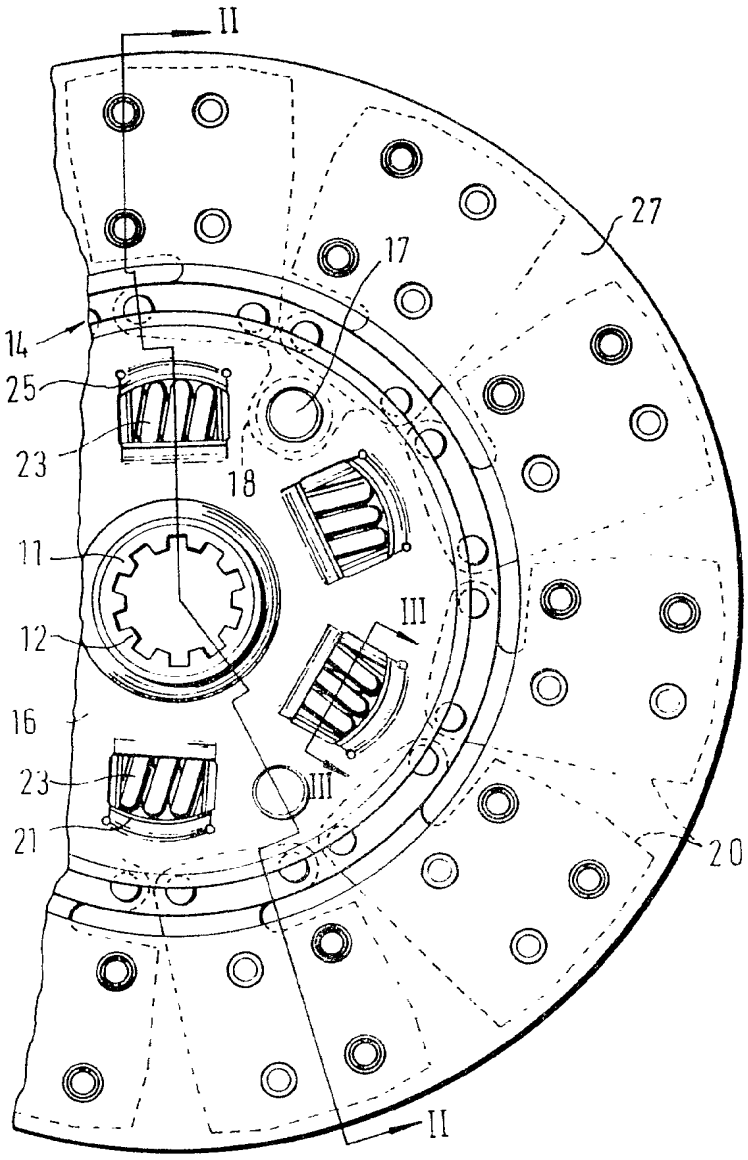


FIG 1

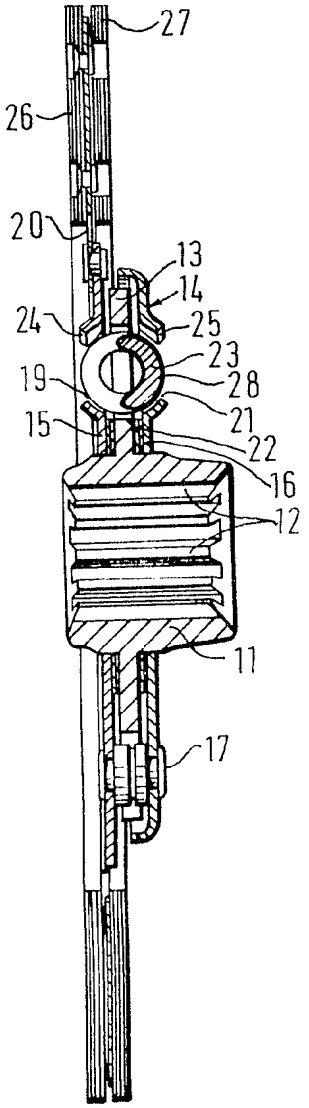
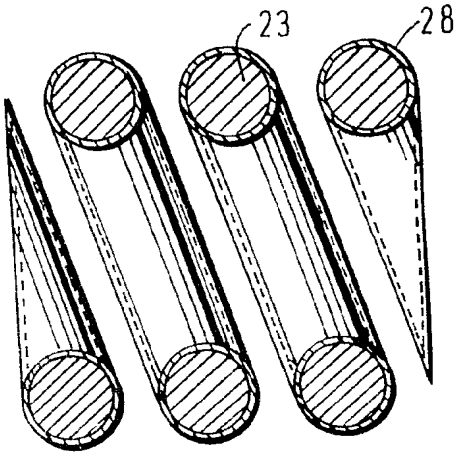


FIG. 2.

FIG. 3.



SPECIFICATION

Torsional vibration dampers

The invention relates to torsional vibration dampers as used in clutch driven plates. A typical clutch driven plate is shown in UK patent specification 1 257 611A. A pair of side plates are driven by friction facing carriers and transmit torque to a flanged hub through helical springs arranged in apertures in the side plates and hub flange.

It is also common to introduce a pre-determined amount of frictional damping between the hub and the side plates but in order to set this friction damping accurately in mass-production it is important to avoid substantial spurious friction. When a friction clutch driven plate is rotating at substantial speed, centrifugal force acts on the springs and presses them firmly into engagement with the outer edge of at least one window. Normally the spring engages angled spring retainers bent out from the material of the side plates at the outer edges thereof. This engagement between springs and outer edges of windows can give rise to substantial friction which alters the damping characteristics of the torsional vibration damper in relation to rotational speed in an unpredictable manner.

An object of the present invention is to provide a torsional vibration damper in which this problem is diminished.

According to one aspect of the invention there is provided a torsional vibration damper comprising at least one side plate, a flanged hub and circumferentially directed helical coil springs arranged in windows in the side plate and hub flange for transmitting drive between the side plate and the hub, wherein said springs or at least one of the windows associated with each spring has a coating of a low friction material. This coating serves to reduce friction between the springs and the windows and enables the overall friction in the torsional vibration damper to be controlled more accurately from one item to the next in a mass-production situation. Preferably the low friction coating is of a hard plastics material such as hard nylon or PTFE. The coating may incorporate a low friction additive such as molybdenum disulphide.

According to a second aspect of the invention there is provided a friction clutch driven plate comprising a driving member and a driven member arranged to be capable of limited relative angular rotation, at least one circumferentially directed helical coil spring arranged in a window of the driving member and a window of the driven member to establish a driving connection through the spring between the members, wherein the spring or the windows associated therewith are coated with a low friction plastics material whereby low friction is achieved between the spring and the windows.

According to a third aspect of the present invention there is provided a friction clutch driven plate comprising a driving member and a driven member arranged to be capable of limited relative angular rotation, at least one circumferentially directed helical coil spring arranged in a window of the driving member and a window of the driven member to establish a driving connection through the spring between the members, wherein the spring or the windows associated therewith are coated with a low friction plastics material whereby low friction is achieved between the spring and at least one of the windows and wherein either the free length of the spring along its own axis, including any coating on the end thereof, is less than the free length of either window or the free length of the spring itself without its coating along its own axis is greater than the length of at least one of the windows.

An embodiment of the invention will be described with reference to the accompanying drawings in which:–

Figure 1 is an end elevation of a friction clutch driven plate incorporating a torsional vibration damper;

Figure 2 is a section on line II–II of Fig. 1; and

Figure 3 is a section on line III–III of Fig. 1 on a larger scale, showing only the helical coil spring.

The friction clutch driven plate shown in the drawings incorporates a hub 11 having internal splines 12 for establishment of a driving connection to a gearbox input shaft (not shown). Hub 11 has an integral outwardly extending radial flange 13.

A friction facing carrier 14 is constituted primarily by two side plates 15 and 16 joined together by rivets 17. Side plates 15 and 16 are positioned one to each side of the flange 13 and are guided by the hub 11 for angular movement with respect to the hub about the hub axis. Rivets 17 pass through recesses 18 in the outer edge of the hub 13 with a clearance in such a way that the rivets 17 act as stop pins to restrict the angular movement between the hub and the carrier 14.

The side plates 15 and 16 and also the hub 13 are provided with aligned openings known as windows as shown at 19, 21 and 22. A steel coil spring 23 is arranged in each set of aligned windows with its axis running in a circumferential direction with respect to the hub axis. Windows 19 and 21 have spring retainers 24 and 25 bent out from the material of the side plates at the edges of the windows.

Side plate 15 carries a series of spring segments 20 which in turn carry two annular friction facings 26 and 27. As thus far described, the driven plate is entirely conventional and corresponds with that described in

UK patent specification 1 257 611 A. In use, torque applied to the friction facings is transmitted to the hub through the springs 23 which allow resilient angular deflection between the hub and the friction facing carrier and thus tend to damp torsional vibrations in the drive through the clutch driven plate. It is of course the springs 23 acting in the windows 19, 21 and 22 of side plates 15 and 16 and hub flange 13 which act as a torsional vibration damper. During axial compression of the springs 23 associated with angular deflection between the hub and the friction facing carrier, there is a tendency for springs 23 to rub against the edges of the windows as these springs are compressed. Particularly when the clutch driven plate is rotating at speed, for example 4000 rpm, centrifugal force acting on the springs forces them in an outward direction into firm engagement with the outer spring retainers 24 and 25. The result is significant frictional resistance to relative rotation between the hub and carrier due to friction between the springs and their retainers. This friction can interfere with correct operation of the torsional vibration damper so it is desirable to reduce or eliminate this friction.

In accordance with the present invention, each spring is coated with a layer of hard, low friction, wear resistant material such as hard nylon or PTFE, possibly containing a low friction additive such as molybdenum disulphide. A spring 23 together with its coating 28 is shown in Fig. 3. In a typical application the springs are dry coated to a thickness of approximately 0.30 mm.

It has been discovered that the provision of the low friction coating on the springs significantly reduces the hysteresis which arises in the clutch driven plate, particularly when the driven plate is rotating at high speed.

As an alternative to applying the coating to the springs themselves, the coating could be applied to the side plates 15 and 16 or at least to the inner surfaces of the spring retainers 24 and 25 of the side plates.

CLAIMS

1. A torsional vibration damper comprising at least one side plate, a flanged hub and circumferentially directed helical coil springs arranged in windows in the side plate and hub flange for transmitting drive between the side plate and the hub, wherein said springs or at least one of the windows associated with each spring has a coating of a low friction material.

2. A friction clutch driven plate comprising a driving member and a driven member arranged to be capable of limited relative angular rotation, at least one circumferentially directed helical coil spring arranged in a window of the driving member and a window of the driven member to establish a driving connection through the spring between the members, wherein the spring or the windows associated therewith are coated with a low friction plastics material whereby low friction is achieved between each spring and at least one window.

3. A friction clutch driven plate comprising a driving member and a driven member arranged to be capable of limited relative angular rotation, at least one circumferentially directed helical coil spring arranged in a window of the driving member and a window of the driven member to establish a driving connection through the spring between the members, wherein the spring or the windows associated therewith are coated with a low friction plastics material whereby low friction is achieved between the spring and the windows and wherein either the free length of the spring along its own axis including any coating on the end thereof is less than the free length of either window or the free length of the spring itself without its coating along its own axis is greater than the length of a window in at least one of the members.

4. A device as claimed in any one of the preceding claims wherein the coating material is hard nylon.

5. A device as claimed in any one of claims 1 to 3 wherein the coating material is PTFE.

6. A device as claimed in claim 4 or claim 5 wherein the material includes a low friction additive such as molybdenum disulphide.

7. A friction clutch driven plate substantially as described with reference to and as illustrated by the accompanying drawings.

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